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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* INDULIS GRUZINS, DONALD FARRELL MCELHENNEY,  
ROBERT C. HIRE, JERRY DOUGLAS NECESSARY, and JOSEPH T.  
FARRELL

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Appeal 2009-000262  
Application 09/996,480  
Technology Center 1600

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Decided:<sup>1</sup> June 19, 2009

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Before RICHARD M. LEBOVITZ, FRANCISCO C. PRATS, and  
MELANIE L. McCOLLUM, *Administrative Patent Judges*.

LEBOVITZ, *Administrative Patent Judge*.

DECISION ON APPEAL

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<sup>1</sup> The two-month time period for filing an appeal or commencing a civil action, as provided for in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

This is a decision on appeal from the Patent Examiner's obviousness rejection of claims 1-25, 27-29, and 31. Jurisdiction for this appeal is under 35 U.S.C. § 6(b). The rejection is affirmed.

#### STATEMENT OF THE CASE

The claims relate to low viscosity carboxyl-containing monomers suitable for use in the synthesis of polyurethanes (Spec. 1:15-16). The monomers are made by reacting a low molecular weight polyol with an acid anhydride in the presence of 5-500 ppm of an organic or inorganic acid catalyst (*id.* at 1:16-19).

Claims 1-25, 27-29, and 31 stand rejected by the Examiner as obvious under 35 U.S.C. § 103(a) in view of Housel (US 6,103,822, Aug. 15, 2000) and Koistinen (WO 98/50338, Nov. 12, 1998) (Ans. 4). The Examiner also cited March (*Advanced Organic Chemistry* 393 (John Wiley & Sons, Inc. 4<sup>th</sup> ed. 1992)) as additional evidence of obviousness (Ans. 8).

Appellants did not separately argue the claims. Therefore, we select claim 13 as representative. Claims 1-12, 14-25, 27-29, and 31 fall with claim 13. *See* 37 C.F.R. § 41.37(c)(1)(vii). Claim 13 reads as follows:

13. A method of preparing a carboxyl-containing monomer comprising the step of combining a low molecular weight polyol compound selected from the group consisting of glycerol, trimethylolpropane, trimethylolethane, polyether polyols, and combinations thereof, and an acid anhydride selected: from the group consisting of maleic anhydride, phthalic anhydride, succinic anhydride, glutaric anhydride, and mixtures thereof in the presence of 25-500 ppm of an organic or inorganic acid, selected from the group consisting of hydrochloric acid, sulfuric acid, nitric acid, formic acid, propionic acid, p-toluenesulfonic acid, oxalic acid, and combination thereof, to produce said carboxyl-containing

monomer, said carboxyl-containing monomer having a viscosity in the range of about 3,000 to about 100,000 cps and having a free oligomer content of less than about 30 mg KOH/g.

#### STATEMENT OF THE ISSUE

Have Appellants established that the Examiner erred in concluding that it would have been obvious to have utilized an acid catalyst in Housel's reaction between a polyol and acid anhydride to produce a product containing a carboxylic acid group?

#### PRINCIPLES OF LAW

The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) secondary considerations of nonobviousness, if any. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966).

"Often, it will be necessary . . . to look to interrelated teachings of multiple [references] . . . and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). "[T]his analysis should be made explicit" (*id.*), and it "can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does."

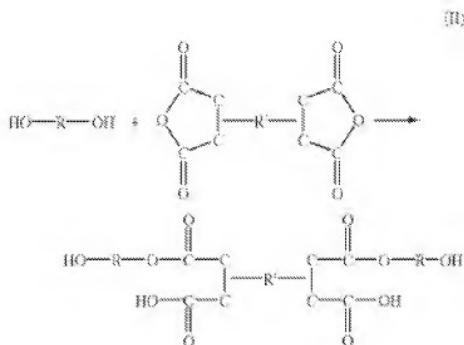
*Id.*

## FACTS

### Scope and content of the prior art

#### *The Housel patent*

- 1.<sup>2</sup> Housel describes a polymeric acid functional polyol which is the reaction product of a nonaromatic polyanhydride and a polyol (col. 3, ll. 28- & 46-51).  
2. Housel states that suitable anhydrides for its process are anhydrides of maleic, phthalic, and succinic acids (col. 6, ll. 37-44).  
3. The polyols useful in Housel's reaction include trimethylol propane (col. 9, l. 66 to col. 10, l. 7).  
4. Housel's "basic reaction" between a polyol and a nonaromatic anhydride is shown below (col. 7, ll. 15-30):



"As shown in reaction (II) [reproduced above], the polyol reacts with the dianhydride to form an acid functionalized polyol in which there are reactive

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<sup>2</sup> The numbered paragraphs include findings and conclusions of fact ("F").

hydroxyl groups, and neutralizable or reactive carboxylic acid groups" (*id.* at 47-51).

5. "The hydroxyl groups in the polymeric polyol react with the anhydride groups in the polyanhydride to form an ester linkage[] and to provide a pendant carboxylic acid group on the polymer backbone" (col. 6, ll. 64-67).
6. Housel states that "typical catalysts" include reactive and unreactive tertiary amine and "organometallic catalysts or metal salt catalysts such as stannous octoate" (col. 13, ll. 11-20). "Catalysts are generally added in an amount of from about 0 to about 30,000 ppm to the reaction mixture" (*id.* at 22-24).
7. According to Housel:

If the temperature is high enough, or certain types of catalysts are used, the carboxylic acid functional groups pendant from the polymeric acid functional polyol chain may be made to react with other hydroxyl groups, but this is an undesired side reaction which should be avoided by carefully monitoring the reaction.

The reaction should take place under conditions that will react the anhydride groups with the hydroxyl terminal groups of the polymeric polyol, but without also reacting a significant amount of the pendant acid groups created from that reaction with other hydroxyl functional groups. . . . Minor amounts of catalysts, such as organometallic catalysts, for example, organotin catalysts, may be added to control the reaction. If the reaction, through use of certain catalysts or a temperature which is too low, occurs too slowly, conversion to an acid functional polyol will take too long. However, if, as a result of the use of particular catalysts or a temperature which is too high, the reaction proceeds too quickly, unwanted side reactions, as discussed above, could occur.

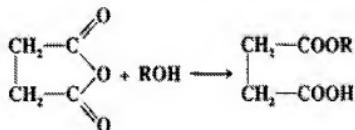
(Col. 7, l. 52 to col. 8, l. 9.)

*The Koistinen application*

8. Koistinen describes a method of preparing polyol esters by reacting a polyol with mono- and polybasic acids in the presence of a catalyst (1, ll. 7-9).
9. The reaction mixture is treated with a base to neutralize the acid components (1, ll. 9-10).
10. Examples of suitable acids described in Koistinen are dicarboxylic acids, such as succinic acid, or cyclic anhydrides, such as succinic anhydride (3, ll. 5-10; 12, l. 23).
11. Examples of polyols include triols, such as trimethylol propane (2, l. 28).
12. According to Koistinen, the esterification reaction is “preferably done” using catalysts (3, ll. 16-17). “[S]ulphuric acid, hydrochloric acid, or metal oxides, such as titanates or tin oxides” are among a list of exemplary catalysts (3, ll. 16-18). “The amount of catalyst used is typically 0.05-0.5 % of the reacting components” (3, ll. 18-19).

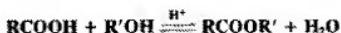
*March*

13. March, in the reaction reproduced below, teaches an esterification reaction between a cyclic anhydride and an alcohol, catalyzed by acids, Lewis acids, and bases (393):



The reaction reproduced above shows that a cyclic acid anhydride when reacted with alcohol produces monoesterified dicarboxylic acids (393).

14. March also describes (reproduced below) the esterification of carboxylic acids with alcohols using an acid catalyst:



March's reaction (shown above) involves reacting a carboxylic acid with alcohol in the presence of an acid catalyst.

Differences between the prior art and the claimed invention

Once the scope and content of the prior art has been identified, the differences between the prior art and the claimed invention must be ascertained. *Graham v. John Deere Co.*, 383 U.S. at 17. To make this determination, we must first address the subject matter of claim 13.

15. Claim 13 is to a method of preparing a carboxyl-containing monomer comprising:

16. "combining a low molecular weight polyol compound" and
17. an acid anhydride
18. "in the presence of 25-500 ppm of an organic or inorganic acid."
19. The polyol and anhydride are selected from a list of recited compounds that include trimethylolpropane and maleic, phthalic, and succinic anhydrides, respectively. The acid is also selected from a list of compounds.
20. The monomer is recited to have "a viscosity in the range of about 3,000 to about 100,000 cps" and "a free oligomer content of less than about 30 mg KOH/g.

Next, we compare the prior art to claim 13.

21. Appellants do not dispute that Housel describes a reaction process between a polyol and an acid anhydride (*see* F1-5) which involves the same reactants as claimed (F15-19).
22. Appellants also do not dispute that the reaction process of Housel and Koistinen, as combined by the Examiner, would result in a product with the viscosity and oligomer content (F20) of claim 13.
23. Housel's process differs from the claim because the claimed reaction occurs in the presence of "25-500 ppm of an organic or inorganic acid" (F18), but Housel does not teach carrying out its reaction with an acid (*see* Ans. 5).
24. This difference is said by the Examiner to have been met by Koistinen who describes a process similar to Housel's, but being accomplished with an acid catalyst (Ans. 8-9).

#### ANALYSIS

The issue in this appeal is whether the Examiner erred in concluding that it would have been obvious to persons of ordinary skill in the art to have employed Koistinen's acid in Housel's reaction between a polyol and acid anhydride. In making such an obvious determination, explicit reasoning must be provided as to why a person of ordinary skill in the art would have been prompted "to combine the elements in the way the claimed new invention does." *KSR*, 550 U.S. at 418. Accordingly, we must take a hard look at the Examiner's reasons for combining Housel with Koistinen and then determine whether Appellants have identified any flaws in them.

The following factually-supported reasons formed the basis upon which the Examiner found it obvious to combine Housel with Koistinen's teachings (Ans. 8-9):

(1) Housel states that catalysts may be used in its reaction process, but does not limit the catalyst to only those which are disclosed (Ans. 8; F6).

(2) Reactions between a compound having an alcohol group and an acid anhydride, as in claim 13, were known in the prior art to be catalyzed by acids. The evidence for this finding is as follows:

25. Koistinen teaches an esterification process in which a polyol (having an alcohol group) is reacted with an acid anhydride (F8-11) – the same type of reaction as in claim 13. Koistinen discloses that acids can be utilized as catalysts in this process (F12) – as recited in the process of claim 13.

26. The organic chemistry textbook *Advanced Organic Chemistry* by March teaches that acid anhydrides can be reacted with alcohols in the presence of acids (F13). March does not use a polyol as in claim 13, but the March reaction involves the same chemistry in which an alcohol group (provided by the polyol in claim 13; provided by the ROH alcohol in March) reacts with an acid anhydride. Compare claim 13 which reacts alcohol groups of a polyol with an acid anhydride (F16-17).

Based on this evidence, the Examiner concluded:

[I]t would have been obvious to the skillful artisan in the art to be motivated to employ the hydrochloric acid catalyst of Koistinen et al into the Housel et al process as an alternative to the tin oxide catalyst of the Housel et al process because the skilled artisan in the art would expect such a modification to be successful and feasible as guidance shown in Koistinen et al.

(Ans. 7.)

As the Examiner's reasoning was fact-based and logical, we conclude the Examiner provided sufficient evidence to establish *prima facie* obviousness. The burden therefore shifted to Appellants to come forward with rebuttal evidence or arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992); *Hyatt v. Dudas*, 492 F.3d 1365, 1370 (Fed. Cir. 2007).

Appellants contend that "one skilled in this art would not be motivated to try a catalyst other than an organometallic catalyst from the teachings of" Housel (App. Br. 11). Quoting from Housel at column 8, lines 3-9, Appellants contend that Housel "raises . . . potential problems" with the use of catalysts, "but neither discloses nor suggests any solution" (*id.*). Therefore, Appellants conclude that persons of ordinary skill "would be lead either to use no catalyst at all or only the organometallic catalyst that is disclosed" (*id.*).

It is true that Housel states that if "certain types of catalysts are used . . . undesired side reaction[s]" may occur, but Housel explicitly teaches that side reactions can be "avoided by carefully monitoring the reaction" (col. 7, ll. 52-57; F7). Thus, while Housel warns of the adverse effects of certain catalysts, Housel tells the skilled worker to watch as the reaction proceeds, to forestall these effects.

Significantly, Housel does not tell the skilled worker not to use catalysts. To the contrary, Housel states at column 8, lines 1-3: "Minor amounts of catalysts, such as organometallic catalysts, for example, organotin catalysts, may be added to control the reaction." In other words, Housel expressly teaches the addition of catalysts to regulate the reaction between the polyol and acid anhydride. Furthermore, the phrases "such as" and "for example" preceding organometallic and organotin compounds,

respectively, indicates that the latter are exemplary and not the only catalyst types contemplated by Housel.

Claim 13 requires that the reaction occur “in the presence of 25-500 ppm of an organic or inorganic acid.” Appellants contend that Koistinen “teaches away” from the claimed range because its working examples employ concentrations of 0.15 weight percent which is three times the claimed levels (App. Br. 12).

This argument is not persuasive. As stated by the Examiner:

Regardless of how a large amount of the catalyst is used in the examples, Koistinen et al expressly teaches in the specification that the amount of catalyst used is typically 0.05-0.5 % (500 ppm to 5000 ppm) of the reacting components (see page 3, lines 18-19). From this information, the lower limit of the catalyst usage (500 ppm) in the prior art does fall on the claimed range of catalyst amount, which is from 5 to 500 ppm. Therefore, applicants’ argument is irrelevant to the issue of the claimed invention.

(Ans. 11.)

The Examiner cited March for its teaching of acid catalysts to promote the reaction between an alcohol and an acid anhydride. Appellants contend that this reaction does not provide motivation to have modified Housel’s process (Reply Br. 2). Appellants distinguish March from Housel because March teaches a reaction that produces a product with only an acid functional group, while Housel’s product has both the acid and alcohol functional groups (*id.*). “Therefore, there is no concern about what effect the presence of the acid catalyst will have to a product having both an alcohol and an acid functional group.” (*Id.*) Appellants state:

If a catalyst that promotes the reaction of an acid group and an alcohol group is present in the reaction between a polyol and an anhydride, the reaction between a polyol and an anhydride will

not stop at the stage of producing an ester having both alcohol [sic] and acid functional groups. Instead, an esterification reaction between the acid group and the alcohol group with the same molecule can occur and as a result the process will not produce a product having both at least an alcohol group and an acid group.

(*Id.*) To support their argument, Appellants rely on the second March reaction which teaches that an acid catalyst promotes the esterification reaction between a carboxylic acid and alcohol groups (F14; Reply Br. 2).

We acknowledge March's teaching that acid catalyzes the reaction between carboxylic acid and alcohol groups (F14). However, Housel expressly recognizes the potential for this chemical reaction when certain catalysts are used (F7; "If . . . certain types of catalysts are used, the carboxylic acid functional groups pendant from the polymeric acid functional polyol chain may be made to react with other hydroxyl groups . . ."). In these circumstances, Housel did not instruct not to use such catalysts, but instead stated that the "undesired reaction . . . should be avoided by carefully monitoring the reaction" (F7). In other words, the chemical scenario posed by Appellants had been directly addressed by Housel. Appellants' position that the reaction "will not stop" but would continue until esterification has occurred between all pendant alcohol and carboxylic acid groups (Reply Br. 2) was anticipated by Housel.

In their Reply Brief, Appellants raised a new argument not presented in the Appeal Brief.

The gist of the Koistinen reference is that the desired polyol esters can be easily separated from the unreacted acid starting materials by adding a tertiary amine to the reaction mixture and subsequently extracting the formed acid-amine salt into an aqueous solution. See Koistinen page 2, lines 4-9 and page 11, claim 1. If the desired polyol ester produced by the

Koistinen process by employing an acid catalyst has any carboxyl (acid) functional group, the desired polyol ester will form a salt with this tertiary amine and as a result will be extracted into the aqueous solution too. Then there will not be any separation of the desired products and the impurities. This indicates that the desired polyol esters formed by Koistinen et al. process do not contain acid pendant groups.

(Reply Br. 4.)

Like Housel, Koistinen starts with polyols and anhydrides. It is therefore reasonable to believe that Koistinen would produce, at some point in the reaction, esters with pendant carboxylic acid and alcohol groups (*see F4*). Appellants appear to be arguing that such pendant groups would be depleted by the side reaction between the acid and alcohol groups, the same reaction that Housel acknowledges could occur with certain catalysts, but explains how to avoid (F7). Thus, even assuming that Koistinen's reaction product upon *completion* would be devoid of carboxylic acid groups, Housel instructs the skilled worker to monitor the reaction to avoid the side reaction – which, in this case, would mean terminating the reaction prior to completion. It would have been within the level of ordinary skill in the art to avoid the side reaction in view of Housel's expression suggestion to do so (F7).

Appellants states that the “desired polyol ester [in the Koistinen process] will form a salt with this tertiary amine and as a result will be extracted into the aqueous solution too” (Reply Br. 4). Thus, Appellants concludes: “the desired polyol esters formed by Koistinen et al. do not contain pendant acid groups” (*id.*)

We are not persuaded by this argument. The Examiner does not rely on Koistinen for its method of separating reactants from product. Rather,

the Examiner relies on Koistinen for its showing that inorganic acids can be used to catalyze the reaction between an anhydride, such as succinic anhydride, and a polyol (*see Ans.* 7). Thus, even if it were true that a person of ordinary skill would not have used Koistinen's tertiary amine to purify Housel's product, we are not persuaded that an ordinary artisan would have failed to consider it obvious to use an inorganic acid as the catalyst in Housel's reaction, for the reasons discussed above. Furthermore, Appellants have not provided evidence that Koistinen's final reaction product would be devoid of carboxylic acid groups. Attorney's argument is not evidence.

#### CONCLUSION OF LAW

Appellants have not established that the Examiner erred in concluding that it would have been obvious to have utilized an acid catalyst in Housel's reaction between a polyol and acid anhydride to produce a product containing a carboxylic acid group.

#### SUMMARY

The obviousness rejection of claims 1-25, 27-29, and 31 is affirmed.

#### TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED

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